Situation of Turkey Water Potential and Its Usage on the Basis of River Basins

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1.Introduction

The human's water demands increases but water amount does not increase. As a result, water will be very scarce factor in the world in the future. In generally, water be uses in the agricultural, industrial and municaple sectors in the world.

Irrigation has a vital role for increasing and stabilizing agricultural production in Turkey because of scarcity and unreliability of rainfall conditions prevailing during growing season in most part of the country (Kanber and Unlu, 2004). Today, irrigation covers about 20 percent of the world's cropland, and it contributes 40 percent of total food production. Irrigated agriculture is responsible for approximately 70 percent of all the freshwater withdrawn in the world, and more water will be used for irrigation in the future, as world food production continues to increase to meet demand. The challenge for irrigated agriculture today is to contribute to the world's food production and improvement of food security through a more efficient, cleaner and integrated use of water (FAO, 2004).

In the world, some organizations is concerned with sustainable use and conservation of water in agriculture. It assesses water resources and monitors agricultural use; assists in water policy formulation and promotes irrigated agriculture and efficient water use through management innovations, modernization and institutional reforms (FAO, 2004).

In this paper, total water potential and total population is used in evaluation of sufficiency of water resources. And also, some information about Turkey's population and water resources per capita is given. The water potantial and usage of 26 river basins in Turkey have been summarized and evaluated on the basis of river basins. Also, the situation of irrigation in Turkey has been explained.

2.Turkey's Land and Water Potantial

Turkey has 77.95 Mha surface land. The 36.5% of the total land in Turkey is suitable for agriculture (28.05 Mha). Of the total irrigable area (25.85 Mha) 16.6% is being irrigated (4.3 mha) while 65% is not. Only 16% of total water resources are used for irrigation and other purposes. Economically viable irrigation is possible for only 8.5 million hectares (Kanber and Unlu, 2004).

Average annual precipitation is 643 mm in Turkey as a whole but changes from region to region and from year to year, ranging from 250 mm in some regions in some years to 3 000 mm in other regions in other years (Pasin and Altınbilek 1997). In short, average annual rainfall varies greatly according to season, year, and region of the country. Therefore,water shortages are an important problem, specifically for agriculture, in Middle Anatolia and in Southeast Anatolia, where an immense water project is currently under way. Irrigation is essential to sustaining and increasing agricultural productivity in these regions. Moreover, many big cities, such as Istanbul and Ankara, experience severe water shortages for domestic and industrial uses during the summer months.

The 643 mm of average annual precipitation in Turkey translates into an average annual water volume of 501 Gm3. Of this amount, 186 Gm3 ends up as surface runoff. Some 274 Gm3, or about 55% of total precipitation, is lost to transpiration and evaporation. Another 69 Gm3, about 14% of total precipitation, feeds the underground water system. Of this amount, 28 Gm3 returns to the surface via springs and joins the river systems. In addition, 7 Gm3 of water comes into Turkey from neighbouring countries. So, altogether, Turkey's renewable surface- water potential 193 billion cubic meters, but the country cannot use or harness the entire 193 billion cubic meters because of technological, topographical, and geological constraints. An

estimated 95 billion cubic meters /year of Turkey's surface- water runoff cannot be used, but some 98 billion cubic meters can be. Of this amount, 95 billion cubic meters originates in the country, whereas 3 billion cubic meters is transboundary water that originates in neighbouring countries. Some 12 billion cubic meters of renewable underground water flows into the sea and to neighbouring countries, and this water can be tapped. Therefore, Turkey's total renewable water potential is 205 billion cubic meters a year, and of this amount 110 billion cubic meters can be used economically.

3. The Evaluations of Water Potential Situations

3.1 At the Country Level Evaluation

In generally, total water potential and total population is used in evaluation of sufficiency of water resources. In the criteria, unite is cubic meters per capita. In this method, begining of water stress is accepted at 1700 cubic meter per capita in a year. If this value decreases to 1000 and 500 cubic meter, it is called chronic and absolute water stress, respectively. In Turkey, total water potantial per capita in a year is 2900 m3 in 2000 year. But, these values are estimated 2200 m3 in 2025 year. In 2050, it is estimated to bring near to critical value.

Turkey usually assumed in a more favourable position than other Middle Eastern countries because of its larger size, its snowy mountains, climate, and its precipitation. Consequently, it is perceived as holding the key to the solution to Middle Eastern water shortages. But some developed countries has better conditions than our countries conditions (**Figure 1**).

In criteria of available data on freshwater resources in the region indicate that Turkey has more water per capita than other Middle Eastern countries. It is accepted to Turkey as a water -rich country. But, to be rich in water resources, a country must have more than 10 000 m3/person per year.

In fact, it is called water supplies of between 1 000 and 2 000 m3/person per year make a country. When the values drops below 1 000 m3/person per year, the country is classified as water scarce.

Furthermore, rapid population growth, industrialization, and rising standards of living will decrease the annual per capita renewable water potential to critical levels. As can be seen from this figure, Turkey's water resources will be decreasing to critic levels (Onder, 2002).

3.2 At the River Basin Level Evaluation

In this paper, also, water potantial and usage of river basins in Turkey have been summarized and evaluated on the basis of river basins. Also, the situation of irrigation in Turkey has been explained. In Turkey, there are 26 river basin in terms of hydrology (**Figure 2**). Water resources of Turkey in present conditions have sufficient.

4. Future Situation of Water Resources

It is clear that water resources in Turkey are considerably limited. When all irrigable lands are opened to irrigation, roughly 200 km^3 water deficits can be expected and interbasin water transfer should not be considered as a sufficient and suitable solution. Water is a constraint to agricultural productivity in comparison with the extent of existing irrigable land resources, especially for Mediterranean, Central and Southeast Anatolia regions, which are arid and semi-arid regions. Turkey has approximately 26 Mha irrigable lands in spite of the water resources to be allocated for irrigation are not seem to be enough to irrigation of all the lands. It is estimated that in Table 1, only 8.5 Mha areas can be irrigated with present water resources.

Applying deficit irrigation programs including supplemental irrigation and to manage the irrigation systems according to deficit irrigation approach can be considered as best solution. However, this solution is very expensive and requires new approaches. On the other hand, to find new water resources for different purposes including irrigation is another possibility to solve the problems related with insufficient water resources. To use

Table 1 Net Water Requirement in Present and Future

Irrigation Situation	Irrigated Lands (ha)	Average Steady Flow $L.s^{-1}.ha^{-1}$	Net Water Requirement $km^3.year^{-1}$
In present	4261185	1.1	49
In near future	8500000	1.1	96
In future	25635000	1.1	296

(from Kanber at al., 2004)

unconventional water such as brackish water (treated waste water, drainage water), shallow ground water and saline water supplied from different resources is considered to be one of the best solutions. The waste water amount in Turkey from urban and industrial consumption was 3700 and 3000 km3 respectively, in 2001. However, the amount of waste water can only complete part of the deficiency of water resources (Kanber at al., 2004)

The use of drainage and saline water for irrigation seems to be an attractive alternative for solving water scarcity problem. Saline water is a potential source for irrigation. The use of saline water for irrigation increases the quantity of water available for agricultural production if the sustainable management strategies for their utilization are evolved. Such water occur extensively in the arid and semi arid parts of the Mediterranean, Central and Southeast Anatolia regions and are being used for irrigating some summer crops which are tolerant to salinity. Some times saline water is blended with fresh water with different quantity and used to irrigate the salt sensitivity crops. There are enough evidences taken from several studies carried out either in Turkey or in the other countries to show the potentiality of using water with saline up to 6 dS/m for major cereal crops (Hamdy, 2002). Unconventional water use for irrigation gradually increases in a lot of countries where irrigation is evitable but water resources are scarce.

5. Conclusions

In a conclusion, evaluation of total water potential on the basis of river basin is realistic than evaluation of its on the basis of country level. Turkey has very much water resources and land for usable today. But in fact, Turkey can not use soil and water resources effectively.

In present conditions, it is estimated that 8.5 Mha area can be irrigated with the water resources. When all irrigable area are irrigated, about 200 km^3 more water is going to require.

Agriculture is the main consumer of freshwater. For this reason, water saving opportunities should be considered within this domain. Prospective of water saving in agriculture ranges from genetics to agronomic, engineering, and different management options, including the use of non-conventional water resources (Kanber and Unlu, 2004)

To apply the deficit irrigation programs including supplemental irrigation and to manage the irrigation system according to deficit irrigation approach and to find the new water resources can be considered as a best solution. In next future, treated waste water and drainage water, shallow ground water and saline water must be used.

In Turkey, the waste water amount from urban and industrial consumption look likes to complete the little part of the deficiency of water resources in 2001.To use of diluted sea water seems to be only way in future.

In this conditions, the results of some researches showed that saline water decreases the yield quantity and quality on all the plants. The researches have been concentrate about mainly unconventional and sea water using in irrigation under crop.

6. References

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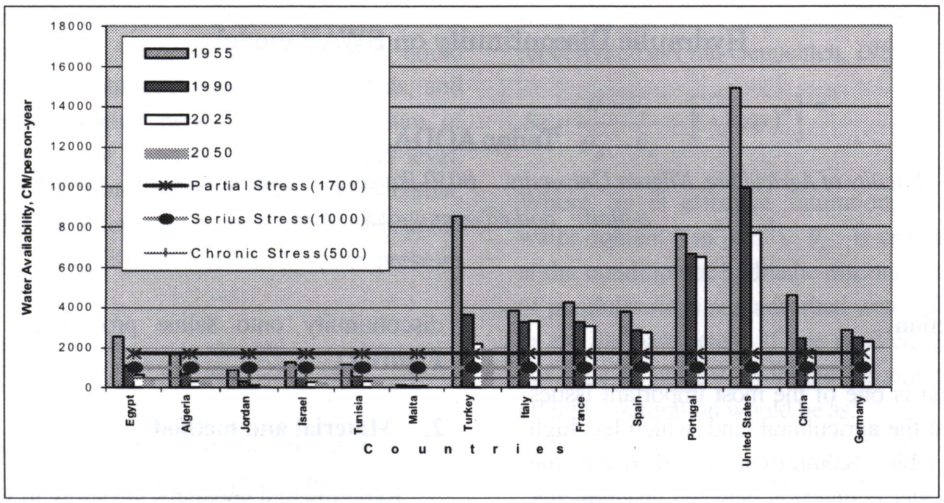

Figure 1 Water Potantial of Turkey vs Other Some Countries

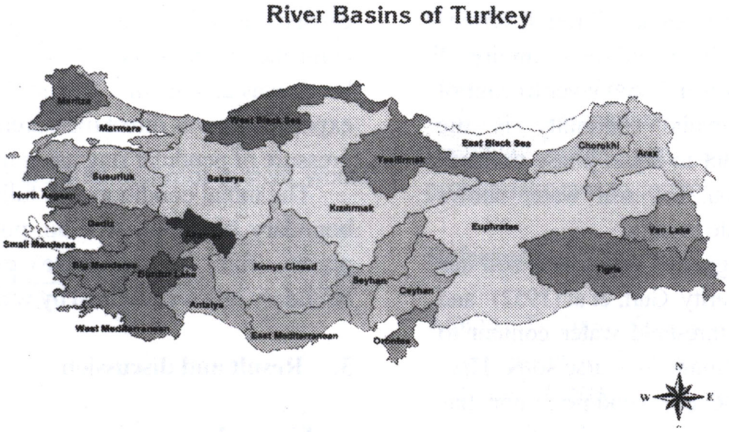

Figure 2 Turkey' s Basin Rivers

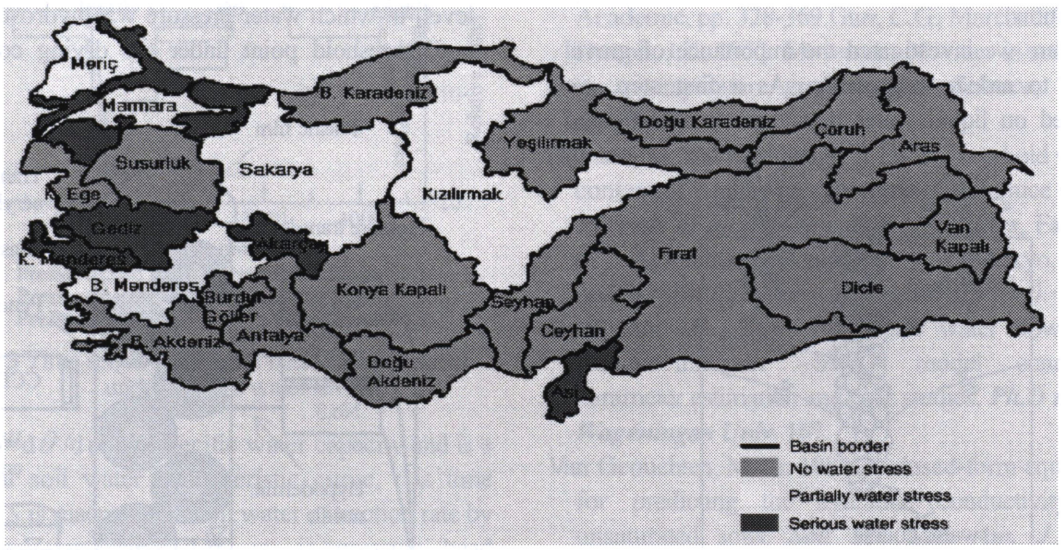

Figure 3 Water Stress Level of Turkey's Basins Rivers